California's Living Marine Resources:
A Status Report

The Resources Agency
The California Department of Fish and Game

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Acknowledgements

The editors wish to acknowledge important contributions from many colleagues. In DFG, Joann Eres and her staff compiled a huge amount of landings data for the tables and graphs, while Nancy Wright and Chad King created the maps. Chamois Andersen and the Conservation Education staff assisted with the editing. Carrie Wilson and Paul Gregory searched out and supplied many of the photographs. Bernice Hammer and Susan Ashcraft aided in organizing and producing tables and graphs. Kristen Sortais from the California Sea Grant Program compiled the glossary and organized the photographs in the document. The ever-enthusiastic Tom Jurach of the UC Davis Repro Graphics Department was the lead person for publication design and layout.

This publication fulfills the Marine Life Management Act of 1998 requirement for a status of the fisheries report. Primary funding for this project was provided by the State of California to the Marine Region of the California Department of Fish and Game. Additional support was supplied by the California Marine Life Management Project with funding from the David and Lucile Packard Foundation and the National Sea Grant College Program of the Department of Commerce, National Oceanic and Atmospheric Administration, under grant number NA06RG0142, project AE/1 through the California Sea Grant College Program.

Library of Congress Control Number: 2001098707

ISBN 1-879906-57-0

University of California

Agriculture and Natural Resources

Publication SG01-11

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Bocaccio

History of the Fishery

Bocaccio (*Sebastes paucispinis*), sometimes called red snapper, rockcod, grouper, salmon grouper, or tomcod (as juveniles), was the dominant rockfish in California's early longline fishery. It was the most abundant rockfish in the bottom trawl fishery from Morro Bay to Fort Bragg until the mid-1980s. In the late 1980s, two-thirds of the bocaccio landed were taken by trawl, with the remainder being taken by set net, longline, and the recreational fishery. Before 1970, estimated landings by all fisheries averaged approximately six million pounds per year. Following 1970, combined landings increased, peaking in 1983 at over 15 million pounds. Landings have declined steadily since then, and fell below 0.5 million pounds in 1998. In 1978, nearly 40 percent of the sampled trawl landings contained half or more bocaccio by weight, but this value has declined to a very small percentage of landings in recent years.

Recreational catches of bocaccio are generally made on rocky reefs by party boat fishermen at depths of 250 to 750 feet. In some years, however, juveniles concentrate in shallow sandy areas near piers off central and southern California, where they are easily taken on small baited hooks. Estimated catches for the recreational fishery are available from 1980 onward and averaged 15 percent of the total landings in recent years. Recreational catches since 1984 have shown the same decline as the trawl fishery.

Status of Biological Knowledge

Bocaccio range from central Baja California to Kodiak Island, Alaska, and are common from northern Baja California to the Washington-British Columbia border. Genetic studies indicate partial separation between the bocaccio population off the Pacific Northwest and that off California.

Among rockfishes, bocaccio are noted for their relatively rapid growth, large adult size, and high variation in year-class strength. They are known to attain a length of 36 inches, a weight of 15 pounds, and a maximum age of about 50 years. Some fast growing individuals are caught with trawl gear at age one, and substantial numbers are landed by age two at lengths of about 16 inches.

Bocaccio are live-bearing fish. At extrusion (release), larvae are about 0.25 inch in length and absorb yolk from the egg stage during the first eight to 12 days. They grow rapidly to about seven inches by the end of their first year. A few mature when they are three years old, about 14 inches long and one pound. Fifty percent are mature at 16.5 inches and four years. Males mature at a slightly smaller size than females. By the time they are 10 years old, they average over 24 inches and weigh five pounds. The number of developing eggs increases from 20,000 in a 15-inch fish to about 2.3 million in a fish 30.5 inches long.

Off central and northern California, larval release occurs from January through May, peaking in February. In southern California spawning takes place from October through July, peaking in January. In central California, most larvae that survive to the juvenile stage are born in January and February, but months of successful reproduction can shift substantially from year to year. In southern California, some females produce as many as three broods in a season, but multiple brooding is uncommon farther north.

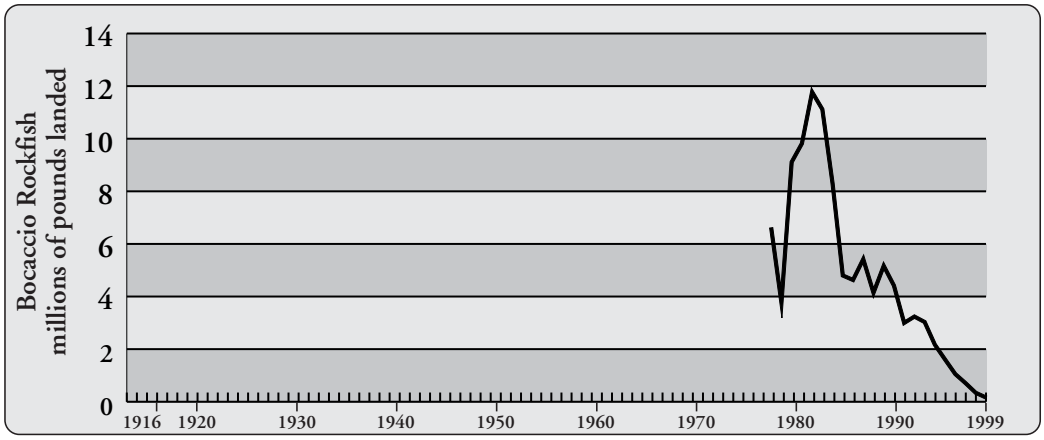
Larval bocaccio are initially pelagic and are most common within 100 feet of the sea surface, where they feed on plankton. Larval bocaccio have been captured in plankton nets as far as 300 miles from shore. By late May or early June, they settle to the bottom at lengths of 1.5 to 2.5 inches, often in kelp beds. Before completing their first year of life, these fast growing young-of-the-year start eating the young of other rockfishes, surfperch, jack mackerel, and various small inshore fishes. Adults are found from depths of 60 to 1550 feet. They feed on smaller rockfishes, sablefish, anchovies, lanternfish, and squid.

Status of the Population

During the past two decades bocaccio landings have been dominated by the 1977, 1984, and 1986 year classes. A long string of recruitment failures occurred from 1989 to 1998, which under intense fishing led to a severely depleted population. By 1999, abundance had fallen to about three percent of the level seen in 1969, and the Pacific Fishery Management Council declared the population as "overfished." Evidence from entrainment of young fish at the San Onofre Nuclear Generating Station indicates that the 1999 year class is large.

Bocaccio, *Sebastes paucispinis*
Credit: DFG

Commercial Landings 1916-1999, Bocaccio Rockfish
Data Source: CalCom, a cooperative survey with input from Pacific Fisheries Information Network (PacFin), National Marine Fishery Service (NMFS), and California Department of Fish and Game (DFG). Data are derived from DFG commercial landing receipts with expansions based on port samples collected by PacFin samplers. Expansion data not available for years prior to 1978.



Management Considerations

See the Management Considerations Appendix A for further information.

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Historic photo of a catch of boccaccio and chilipepper being unloaded from a trawler. Credit: DFG

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in obtaining cost-effective data for fisheries management. A future cooperative research study of the angel shark population could also shed light on the effectiveness of a large "no-take" marine reserve, at least on this single resident species.

Further studies on the genetic variability of geographically separated island and mainland stocks would provide resource managers with valuable information in developing a fisheries management plan. A review of the socio-economic impacts of the area closures on small scale fisheries, coastal communities, and local economies could also provide managers with tools to assess the pros and cons of incorporating marine reserves in future management strategies.

The fishing industry, university researchers, and resource managers might seek to initiate a cooperative program with Mexico to assure a sustainable angel shark fishery that can continue to supply both Mexican and U.S. markets.

Barred Sand Bass

This species seems to be a good candidate for the establishment of harvest refugia in some areas during peak spawning times.

Bay Shrimp

The current lack of catch limits, closed seasons or restricted areas is based upon the assumption that limited demand for bay shrimp maintains effort at levels far below the level that would threaten long-term sustainability of the fishery. Data is not available to test this assumption. Because of this, the following measures are suggested:

1. Continue the compilation of bay shrimp logbook data to get past and current catch per unit effort, as well as maintaining logbook requirements for commercial fishery participants.
2. Monitor species composition in bay shrimp landings. Currently, four species are known to be caught in the fishery with indications that a newly introduced fifth species may also be of importance. Long-term shifts in species landed by the fishery may be indicative of broader problems in the populations of each species.

Bocaccio

Bocaccio have been managed under the Groundfish Management Plan of the Pacific Fishery Management Council since 1982. The bocaccio population is now under a formal rebuilding program, requiring severe restrictions on fishing opportunities. The length of time needed to rebuild the population depends on the frequency of rare large year classes, but may require 40 years under conditions similar to those seen in recent years.

Bull Kelp

In order to ensure a productive future for California's bull kelp resource and the species dependent on it, the following considerations are offered:

1. Continue the present management system for the 300-series beds, including the harvest prohibition for beds 303-307.
2. Modify the present 15 percent harvest-limit on the leasable 300-series beds to require distribution of the harvest throughout the bed to minimize local impacts.
3. Prohibit harvest of bull kelp in beds where the bull kelp resource has been shown to be chronically diminished during the past several decades.
4. Encourage the use of alternative feeds, some of which have already been developed for cultured species such as red abalone.
5. Fund more regular assessments and more research to examine the impacts of various harvest strategies.

Cabezon

In recent years, federal groundfish management policy has resulted in drastic reductions in allowable take of many groundfish species due to the overfished status of some species such as lingcod, bocaccio, and canary rockfish. These reductions in turn have shifted effort to more lucrative markets, such as the live-fish fishery. For bocaccio and canary rockfish, the efforts required to rebuild stocks will restrict harvest levels for all associated species for several years, so fishing pressure on cabezon and other nearshore groundfish species is not likely to decrease, and may increase further, without some intervention. DFG developed interim management measures to further address increasing demands on these nearshore fish populations. Measures for cabezon include:

1. An increase in the minimum size limit.
2. A closed commercial and recreational fishery during spawning and nest guarding seasons.

In addition, the department is mandated to develop a Nearshore Fishery Management Plan, which will include cabezon and may be adopted by the Fish and Game Commission in January 2002.